

Weekly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.001923)^{260}}$$

$$= 606.83$$

Ex - 20

$$FV = PV (e^{im})$$

$$= 50,000 (e^{0.10 \times 15})$$

$$= 224,084.1535$$

Ex - 22

We know,

$$PV = FV (e^{-in})$$

$$= 10,000 (e^{-0.10 \times 5})$$

$$= 6,065.30$$

$$n = \frac{10\%}{52}$$

$$= 0.001923$$

$$n = 5 \times 52$$

$$= 260$$

$$PV = 50,000$$

$$i = 10\%$$

$$t = 15$$

$$n = 15$$

$$FV = 20,000$$

$$i = 10\%$$

$$t = 5$$

$$n = 5$$

Weekly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$2 = \frac{1000}{(1+0.001923)^n}$$

$$n = 606.83$$

Ex - 20

$$FV = PV (e^{in})$$

$$= 50,000 (e^{0.10 \times 15})$$

$$= 224,089.1595$$

Ex - 22

We know,

$$PV = FV (e^{-in})$$

$$= 20,000 (e^{-0.20 \times 5})$$

$$= 6065.30$$

$$r = \frac{10\%}{52}$$

$$= 0.001923$$

$$n = 7 \times 52$$

$$= 364$$

$$PV = 50,000$$

$$i = 10\%$$

$$n = 15$$

$$n = 15$$

$$FV = 20,000$$

$$i = 20\%$$

$$n = 5$$

$$n = 5$$

Mathematics of Finance

(200 marks) Time Value of Money

What is Interest?

3th - 2000

2000 → 200

Principal (2000)

$I = P \times R \times T$ → Rate of Interest
amount of year
of Interest

$$I = 2000 \times 5 \times 0.10$$

$$= 1000$$

$$A/FV = P + I$$

$$= 2000 + 1000$$

$$= 3000$$

Contents

1. Interests
2. Simple Interests
3. Compound Interest
4. Nominal and effective rates of Interest.

5. Continuous Compounding
(VARS B236) 9

6. Discounting

7. Depreciation

8. Annuity

9. Derivation of Different

type of Annuity

10. Amortization

4 sinking Funds

11. Business

Applications

Mathematics of Finance

(exam strategy) Time Value of Money

What is Interest?

Ex - answer

200 → 200

↑
Principal (200)

↑
I = Principal of Interest
amount of Interest

$$I = 1000 \times 5 \times 0.10$$

$$= 500$$

$$A/FV = P + I$$

$$= 1000 + 500$$

$$= 1500$$

Contents

1. Interests
2. Simple Interest
3. Compound Interest
4. Nominal and effective rates of Interest.

5. Continuous Compounding

Present Value (from PVIC) ↓
Discounting

7. Depreciation

8. Annuity

9. Division of different

type of Annuity

10. Amortization

4 sinking Funds

12. Business Applications

Value starts same ✓ Compound Interest.

1000	10%	①	1000
1100	10%	②	1100
1210	10%	③	1221
1331	10%	④	1331
1464.10	10%	⑤	1614.91
			<u>610.91</u>

$P = 1000 \rightarrow$ Payed 20 years

$n = 5$

$I = 10\% \rightarrow 0.10$

INTEREST

$m = 360$

$FV \rightarrow ?$

$$FV = P \left(1 + \frac{r}{m} \right)^{nm}$$

$$= 1000 \left(1 + \frac{0.10}{360} \right)^{360}$$

$$= 1000 \left(1 + 0.002778 \right)^{360}$$

$$= 1614.91$$

Value starts same ✓ Compound Interest.

$$1000 \frac{10\%}{1} \text{ ① } 1000$$

$$1100 \frac{10\%}{2} \text{ ② } 110$$

$$1210 \frac{10\%}{3} \text{ ③ } 121$$

$$1331 \frac{10\%}{4} \text{ ④ } 133.1$$

$$1464.10 \frac{10\%}{5} \text{ ⑤ } 146.41$$

$$\underline{620.52}$$

$11 \times 1000 \rightarrow 11000$ to be received

$$m = 5$$

$$I = 10\% \rightarrow 0.10$$

$$10000 \text{ (10000)} \rightarrow 10000 \left(1 + \frac{0.10}{5}\right)^{5n}$$

$$m = 980$$

$$FV \rightarrow 2$$

$$= 1000 \left(1 + \frac{0.10}{980}\right)$$

$$= 1000 \left(1 + \frac{0.000278}{1}\right)$$

$$= 1000.278$$

34,

→ 35

$$FV = PV(e^{in})$$

$$= 1000 (e^{.10 \times 5})$$

$$= 1000 \times e^{.50}$$

$$= 1648.72$$

Business of Communication

32,

$$FV = PV(e^{in}) \rightarrow 10$$

$$= 1000(e^{.20 \times 5})$$

$$= 1000 \times e^{1.0}$$

$$= 1698.72$$

Business of Communication

Mathematics of Finance

→ Annuity $\Rightarrow$ ⁽ⁱ⁾ ordinary annuity

(ii) ~~As~~ Annual annuity

Annuity - ३३। ३३३ ३३३

Annuity $\rightarrow$ n equal payments.

3) An increasing trend in the number of
income tax returns.

प्रश्न :- 3 Non Active

FVA not set to 40 hours

$FV \rightarrow 875, 1200$
 $\bullet A \quad 2 \quad PMT$
 $A \quad \left\{ \frac{(1+r)^n - 1}{r} \right\}$

$$FV_{AD} = \textcircled{M}_T^A \left\{ \frac{(1+r)^n - 1}{r} \right\} (1+r)$$

~~DAW~~

6.7.

sample 2-7

Mathematics of finance

→ Annuity $\Rightarrow$ ^① zero ^② growing annuity

(ii) ~~As~~ Annual annuity

Annuity - ३६ | २४३६ ३६

Annot. Annuity 10% $\rightarrow$ savings on 10%

③ A summary sheet of the above two is
income statement also.

42: 3 context

F_{VA} and F_{VB} are the forces exerted by the water on the vertical plates A and B.

$$FV_{OA} = PMT_A \left\{ \frac{(1+r)^n - 1}{r} \right\}$$

$$FV_{AD} = Y_{MT}^A \left\{ \frac{(1+r)^n - 1}{r} \right\} (1+r)$$

11/11/11

6.3.

2-7

QNT-2]

$$\therefore I = \text{Amount of simple}$$

$$\therefore I = 10,000 \times 0.10 \times 10$$

$$= 10,000$$

where,

A = Amount of at the end year

P = Principal amount

I = Amount of simple interest.

Here,

$$A = ?$$

$$P = 10,000$$

$$I = 10,000$$

$$A = P + I$$

$$= 10,000 + 10,000$$

$$= 20,000 \text{ (Ans)}$$

Here,

$$I = 10,000$$

$$P = 20,000$$

$$i = 10\%$$

$$= 0.10$$

$$n = 10 \text{ year}$$

Q. 2]

$\therefore I = \text{Amount of simple}$

$\therefore I = 10,000 \times 0.10 \times 10$

$= 10,000$

Here,

$I = 10,000$

$P = 10,000$

$i = 10\%$

$= 0.10$

$n = 10 \text{ years}$

Where,

$A = \text{Amount of at the end year}$

$P = \text{Principal amount}$

$I = \text{Amount of simple interest}$

Here,

$A = ?$

$P = 10,000$

$I = 10,000$

$A = P + I$

$= 10,000 + 10,000$

$= 20,000 \text{ (Ans)}$

Qnt - 2)

We know,

$$A = P(1 + in)$$

Where,

A = Amount of the sum

P = Amount of principal

i = Rate of interest

n = Number of years

Where, $A = 7500$

$P = ?$

$i = 10\%$

$n = 5$ years

$$\text{So, } 7500 = P(1 + 0.10 \times 5)$$

$$\text{Or, } 7500 = P(1.50)$$

$$\text{Or, } 7500 = P(1.50)$$

$$\text{Or, } P = \frac{7500}{1.50} = 5000 \text{ Tk}$$

Qnt - 2)

We know,

$$A = P(1 + in)$$

Where,

A = Amount of the sum

P = Amount of Principal

i = Rate of interest

n = Number of years

Where,

$$A = 7,500$$

$$P = ?$$

$$i = 10\%$$

$$= 0.10$$

$$n = 5 \text{ years}$$

$$\text{So, } 7,500 = P(1 + 0.10 \times 5)$$

$$\text{OR, } 7,500 = P(1 + 0.50)$$

$$\text{OR, } 7,500 = P(1.50)$$

$$\text{OR, } P = \frac{7,500}{1.50} = 5,000 \text{ Tk}$$

Ex-6

We know,

$$A = P(1 + in)$$

Where, A = Amount in Future

P = Amount of principal

i = rate of simple interest

n = number of years

$$\text{So, } 17,000 = 10,000(1 + 10i)$$

$$\text{or, } \frac{17,000}{10,000} = 1 + 10i$$

$$\text{or, } 1.7 = 1 + 10i$$

$$\text{or, } 1.7 - 1 = 10i$$

$$\text{or, } 0.7 = 10i$$

$$\text{or, } i = \frac{0.7}{10} = 0.07$$

$$\text{So, } i = 7\%$$

Hence,

$$A = 17,000$$

$$P = 10,000$$

$$n = 10 \text{ years}$$

$$i = 7\%$$

Ques-6)

We know,

$$A = P(1 + in)$$

Where, A = Amount in Future

P = Amount of principal

i = rate of simple interest

n = number of years

$$\text{So, } 17,000 = 10,000(1 + 10i)$$

$$\text{or, } \frac{17,000}{10,000} = 1 + 10i$$

$$\text{or, } 1.7 = 1 + 10i$$

$$\text{or, } 1.7 - 1 = 10i$$

$$\text{or, } 0.7 = 10i$$

$$\text{or, } i = \frac{0.7}{10} = 0.07$$

$$\text{So, } i = 7\%$$

Hence,

$$A = 17,000$$

$$P = 10,000$$

$$n = 10 \text{ years}$$

$$i = 7\%$$

Time Value of money

30th ~~20th~~

$I = \text{Rate of Interest} \times P$

$$I = p_{nn}$$

$$A/FV = P_i + I$$

≈ 1500

⑪ Business Application

Mathematics of Finance

Time Value of money

What is interest?

→ ~~350~~ ~~3000~~

1000 रु. 5% दर पर 5 वर्षों के लिए

1000 रु. 5% दर पर 5 वर्षों के लिए

2000 रु. 5% दर पर 5 वर्षों के लिए

I = Rate of Interest →

P = Principal →

$$I = P \times R$$

$$I = 1000 \times 5 \times 0.10$$

$$= 500$$

$$A/FV = P + I$$

$$= 1000 + 500$$

$$= 1500$$

Contents

1. Interests

2. Simple Interest

2. Compound Interest

4. Nominal and effective

5. Continuous compound
(वर्तमान दर)

⑥ Depreciation

⑦ Discounting

⑧ Annuity

⑨ Derivation of different
type of annuity

⑩ Amortization

sinking Funds

⑪ Business Application

Amount to accumulate

32,

$$FV = PV (e^{in}) \rightarrow 320 \text{ units unit}$$

$$= 1000 (e^{.10 \times 5})$$

$$= 1000 \times e^{.50}$$

$$\text{Amount} = 2648.72$$

H.W

Ex 6)

$$FV_{OA} = PMT \left\{ \frac{(1+i)^n - 1}{i} \right\}$$

$$= 1.00 \left\{ \frac{(1+.10)^5 - 1}{.10} \right\}$$

$$= 1.00 \times \frac{.62052}{.10}$$

$$= 6.1052$$

Amount to accumulate

Amount to accumulate

Amount to accumulate

Amount to accumulate

Amount to accumulate

$$PMT = 1.00$$

$$i = 10\%$$

$$= 0.799 = I$$

$$n = 5$$

or

1 + 1 + 1 + 1 + 1

1000

1000

Q1,

$$FV = P_0 (e^{rt}) \rightarrow \text{SPD} \text{ only unit}$$

$$= 1000 (e^{0.10 \times 5})$$

$$= 1000 \times e^{0.50}$$

$$= 1000 \times 1.64872$$

$$= 1648.72$$

HW

unit

the number of times is

the number of times is

the number of times is

the number of times is

the number of times is

Ex G)

$$FV_{OA} = PMT \left\{ \frac{(1+r)^n - 1}{r} \right\}$$

$$= 1.00 \left\{ \frac{(1+0.10)^5 - 1}{0.10} \right\}$$

$$= 1.00 \times \frac{0.62052}{0.10}$$

$$= 6.2052$$

$$PMT = 1.00$$

$$r = 10\%$$

$$= 0.791$$

$$n = 5$$

$$1.00 \times 6.2052 = 6.2052$$

the number of times is

Ex - 7

We know

$$FVAD = PMT \left\{ \frac{(1+r)^n - 1}{r} \right\} (1+r)^n$$

$$= 1.00 \left\{ \frac{(1+0.10)^5 - 1}{0.10} \right\} (1+0.10)$$

$$= 1.00 \left\{ \frac{0.61051}{0.10} \right\} (1+0.10)$$

$$= 1.00 \times 6.71561$$

$$= 6.71561$$

Part - B

Problem - B1

$$A. FVIF = (1+r)^n \quad \left| \quad \begin{array}{l} n = 12-1 \\ = 12 \end{array} \right.$$

$$= (1+0.12)^2$$

$$= 1.2544$$

Ex-7

We know

$$FV_{AD} = PMT \left\{ \frac{(1+r)^n - 1}{r} \right\} (1+r)^n$$

$$= 1.00 \left\{ \frac{(1+0.10)^5 - 1}{0.10} \right\} (1+0.10)^5$$

$$= 1.00 \left\{ \frac{0.61051}{0.10} \right\} (1+0.10)^5$$

$$= 1.00 \times 6.71561$$

$$= 6.71561$$

Part - B

Problem - P1

$$A. FVIF = (1+r)^n$$

$$= (1+0.12)^2$$

$$= 1.2544$$

$$r = 12\%$$

$$= 0.12$$

$$n = 2$$

$$(1+0.12)^2$$

$$= 1.2544$$

Problem - B2

$$\begin{aligned} \text{B. FVIF} &= (1+r)^n \\ &= (1.06)^3 \\ &= 1.1910 \end{aligned}$$

$$\begin{aligned} r &= 6\% \\ &= 0.06 \\ n &= 3 \end{aligned}$$

$$\begin{aligned} \text{C. FVIF} &= (1+r)^n \\ &= (1.09)^2 \\ &= 1.1881 \end{aligned}$$

$$\begin{aligned} r &= 9\% \\ &= 0.09 \\ n &= 2 \end{aligned}$$

$$\begin{aligned} \text{D. FVIF} &= (1+r)^n \\ &= (1.03)^4 \end{aligned}$$

$$\begin{aligned} r &= 3\% \\ &= 0.03 \end{aligned}$$

Problem - B2

Compounded yearly

$$\begin{aligned} \text{FV} &= \text{PV}(1+r)^n \\ &= 12000(1+0.12)^5 \\ &= 12000 \times 1.7623 \end{aligned}$$

$$n = 5$$

Problem - B2

$$\begin{aligned} \text{B. FVIF} &= (1+r)^n \\ &= (1.06)^3 \\ &= 1.1910 \end{aligned}$$

$$\begin{aligned} r &= 6\% \\ &= 0.06 \\ n &= 3 \end{aligned}$$

$$\begin{aligned} \text{C. FVIF} &= (1+r)^n \\ &= (1.09)^2 \\ &= 1.1881 \end{aligned}$$

$$\begin{aligned} r &= 9\% \\ &= 0.09 \\ n &= 2 \end{aligned}$$

$$\begin{aligned} \text{D. FVIF} &= (1+r)^n \\ &= (1.03)^4 \\ &= 1.1235 \end{aligned}$$

$$\begin{aligned} r &= 3\% \\ &= 0.03 \\ n &= 4 \end{aligned}$$

Problem - B2

Compounded yearly

$$\begin{aligned} \text{FV} &= \text{PV}(1+r)^n \\ &= 12000(1+0.12)^5 \\ &= 12000 \times 1.7623 \end{aligned}$$

Time Value of money

Present value of money

$$FV = PV(1+r)^n$$

Pat

$$PV(1+r)^n = FV$$

$$PV = \frac{FV}{(1+r)^n}$$

$$of = N$$

$$of = N$$

$$P = M$$

$$PV = 30,360$$

$$\left(\frac{1}{1+r} \right)^n = \frac{PV}{FV}$$

$$V7$$

$$V9$$

$$\left(\frac{1}{1+r} \right)^n = \frac{PV}{FV}$$

$$FV = 10,000$$

$$000.01$$

$$n = 10$$

$$of (1+r)^n$$

$$P048$$

Exam:- 21

$$PV = \frac{10,000}{(1+0.10)^{10}}$$

$$= \frac{10,000}{2.5937}$$

$$= 3855.49$$

is ... of ...

22 topic ... H.W

Example 8, 9, 10, 11

$$\frac{V7}{N10}$$

$$V8$$

Time Value of money

Present value of money

$$FV = PV(1+r)^n$$

Ex:

$$PV(1+r)^n = FV$$

$$PV = \frac{FV}{(1+r)^n}$$

Ex: 1

$$PV = \frac{30000}{(1+.10)^{10}}$$
$$= \frac{30000}{2.5937}$$

$$= 11569.43$$

or 11569.43

2nd topic 2nd sub H.4

Example 8, 9, 10, 11

$$\frac{FV}{(1+r)^n}$$

$$PV$$

Interest Compounding 90 with 50/10

Future Value 100000

$$n = 10$$

$$r = 20$$

$$m = 4$$

$$FV = PV \left(1 + \frac{r}{m} \right)^{nm}$$

→ PV Value at 90

$$PV = \frac{FV}{\left(1 + \frac{r}{m} \right)^{nm}}$$

$$\frac{10,000}{\left(1.025 \right)^{40}}$$

$$= 3724$$

Effective rate in compounding 20

$$FV = PV (e^{in})$$

$$PV = \frac{FV}{e^{in}}$$

verjuste compoundings to make with

for 2000

27

25-30

4
2
3

$$f(x) = \frac{1}{x^2} = x^{-2}$$

$$p_v = \frac{f_v}{\left(1 + \frac{r_{v \times m}}{m}\right)}$$

$$\begin{array}{r} 10,000 \\ 2.5 \overline{) 25} \end{array} \begin{array}{l} 10 \\ (1.025) \end{array}$$

3724

As confirmed in our
- 342143

$$FV = PV(e^{in})$$

$$F_v = \frac{F_v}{v}$$

$$= \frac{10,000}{e^{10 \times 10}}$$

H.W.

Ex-08

We know,

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{10000}{(1+0.10)^5}$$

$$= 6209.21$$

Ex-09

Half yearly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.05)^{10}}$$

$$= 613.91$$

$$FV = 10,000$$

$$R = 10\%$$

$$= 10$$

$$n = 5$$

$$FV = 1000$$

$$R = \frac{10\%}{2}$$

$$= 5\%$$

$$= 10$$

$$n = 5 \times 2$$

$$= 10$$

$$= \frac{10,000}{e^{.10 \times 10}}$$

H.V

Ex-08

We know,

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{10000}{(1+0.10)^5}$$

$$= 6209.21$$

Ex-09

Half yearly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.05)^{10}}$$

$$= 628.92$$

$$FV = 10,000$$

$$R = 10\%$$

$$n = 10$$

$$n = 5$$

$$FV = 1000$$

$$R = \frac{10\%}{2}$$

$$= 0.05$$

$$n = 5 \times 2$$

$$= 10$$

Quarterly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.25)^{20}}$$

$$= 610.27$$

Bimonthly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.1667)^{30}}$$

$$= 608.98$$

Monthly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.0833)^{60}}$$

$$= 607.79$$

$$r = \frac{10\%}{4}$$

$$= 0.025$$

$$n = 5 \times 4$$

$$= 20$$

$$r = \frac{10\%}{6}$$

$$= 0.01667$$

$$n = 5 \times 6$$

$$= 30$$

$$r = \frac{10\%}{12}$$

$$= 0.00833$$

$$n = 5 \times 12$$

$$= 60$$

Quarterly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.25)^{20}}$$

$$= 620.27$$

Bimonthly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.1667)^{30}}$$

$$= 608.98$$

Monthly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.0833)^{60}}$$

$$= 607.79$$

$$r = \frac{20\%}{4}$$

$$= 0.025$$

$$n = 5 \times 4$$

$$= 20$$

$$r = \frac{20\%}{6}$$

$$= 0.0333$$

$$n = 5 \times 6$$

$$= 30$$

$$r = \frac{20\%}{12}$$

$$= 0.0167$$

$$n = 5 \times 12$$

$$= 60$$